IN THE CLAIMS

We claim:

1. A method of annealing a dielectric layer, said method comprising the steps of:

forming a dielectric layer on a substrate;

generating an active atomic species in a first chamber; and

exposing said dielectric layer to said active atomic species wherein said substrate is located in a second chamber separate from said first chamber while exposing said dielectric layer to said active atomic species.

2. The method of claim 1 wherein said active atomic species comprises reactive oxygen atoms.

3. The method of claim 1 wherein said active atomic species comprises reactive nitrogen atoms.

4. The method of claim 1 wherein said dielectric layer comprises a metal-oxide.

5. The method of claim 1 wherein said dielectric layer comprises a transition metal dielectric.

6. The method of claim 5 wherein said dielectric layer comprises tantalum pentaoxide (Ta_2O_5).

7. The method of claim 1 wherein said dielectric layer is exposed to said active atomic species while being heated to a temperature of less than 400°C.

8. A method of forming a dielectric layer comprising:

generating an active atomic species in a first chamber; and

depositing a dielectric layer onto a substrate by chemical vapor deposition in a second chamber and while depositing said dielectric layer, providing said active atomic species into said second chamber.

9. The method of claim 8 wherein said active atomic species comprises oxygen radicals.

10. The method of claim 8 wherein said dielectric layer a metal oxide dielectric.

11. The method of claim 8 wherein said dielectric layer comprises a transition metal dielectric.

12. The method of claim 11 wherein said dielectric layer comprises tantalum pentaoxide (Ta_2O_5).

13. The method of claim 8 wherein said dielectric layer comprises a silicon-oxide.

14. A method of annealing a deposited oxide, said method comprising the steps of:

locating a substrate in a first chamber, said substrate having a deposited oxide formed thereon;

generating reactive oxygen atoms in a second chamber; and

transporting said reactive oxygen atoms from said second chamber into said first chamber and exposing said deposited oxide to said reactive oxygen atoms.

15. The method of claim 14 wherein said deposited oxide is exposed to said reactive oxygen atoms while heating said substrate to at a temperature of less than 400°C.

16. The method of claim 14 wherein said second chamber is a microwave applicator cavity of a remote plasma generator.

17. The method of claim 14 wherein said reactive oxygen atoms are formed by generating a plasma from O_2 molecules.

18. The method of claim 14 wherein said reactive oxygen atoms are formed by generating a plasma from N_2O molecules.

19. The method of claim 14 wherein said reactive oxygen atoms are formed by generating a plasma from O_2 molecules utilizing microwaves.

20. The method of claim 14 wherein said deposited oxide is a silicon-oxide.

21. The method of claim 14 wherein said deposited oxide is a metal-oxide.

22. The method of claim 21 wherein said deposited metal oxide is a transition metal oxide.

23. The method of claim 22 wherein said transition metal-oxide is tantalum pentaoxide (Ta_2O_5).

24. A method of forming a capacitor, said method comprising the steps of:

forming a bottom electrode;

depositing a transition metal dielectric on said bottom electrode in a deposition chamber;

generating reactive oxygen atoms by forming a plasma from an oxygen containing gas in a microwave applicator cavity in a remote plasma generation chamber;

annealing said transition metal dielectric by exposing said transition metal dielectric to said reactive oxygen atoms, wherein said annealing step occurs in a chamber separate from said microwave applicator cavity; and

forming a top electrode on said reactive oxygen atom exposed transition metal dielectric.

25. The method of claim 24 wherein said transition metal dielectric is tantalum pentaoxide (Ta_2O_5) deposited by chemical vapor deposition utilizing a source gas comprising TAETO.

26. The method of claim 24 wherein said transition metal dielectric is tantalum pentaoxide (Ta_2O_5) formed by chemical vapor deposition utilizing a source gas comprising TAT-DMAE.

27. The method of claim 25 wherein said tantalum pentaoxide dielectric layer is formed utilizing a source gas comprising O_2.

28. The method of claim 24 wherein said transition metal dielectric layer is deposited at a temperature between 300-500°C.

29. The method of claim 24 wherein said transition metal dielectric is formed with a source gas comprising N_2O.

30. The method of claim 24 wherein said transition metal dielectric is annealed in the deposition chamber.

31. The method of claim 24 wherein said transition metal dielectric film is annealed at a temperature less than 400°C.

32. The method of claim 24 wherein said transition metal dielectric is annealed in a chamber different than the deposition chamber in which said transition metal dielectric was deposited.

33. A method of forming a dielectric film, said method comprising the steps of:

placing a substrate in the deposition chamber;

heating said substrate to a deposition temperature;

providing a metal source into said chamber;

thermally decomposing said metal source to provide metal atoms;

generating reactive oxygen atoms in a second chamber;

providing said reactive oxygen atoms into said deposition chamber; and

forming a dielectric film on said substrate by combining said metal atoms with said reactive oxygen atoms.

34. The method of claim 33 wherein no other source of oxygen is provided into said deposition chamber other then said reactive oxygen atoms during said formation of said dielectric film.

35. The method of claim 33 wherein said reactive oxygen atoms are formed from a plasma formed by applying microwaves to oxygen gas (O_2).

36. The method of claim 33 wherein said reactive oxygen atoms are formed from a plasma created by applying microwaves to N_2O molecules.

37. A method of passivating a silicon nitride film, said method comprising the steps of:

locating a substrate in a first chamber, said substrate having a silicon nitride layer formed thereon;

generating reactive nitrogen atoms in a second chamber; and

transporting said reactive nitrogen atoms from said second chamber into said first chamber and exposing said silicon nitride film to said reactive oxygen atoms.

38. The method of claim 37 wherein said reactive nitrogen atoms are formed from an anneal gas comprising N_2.

39. The method of claim38 wherein said reactive nitrogen atoms are formed from an anneal gas comprising N_2 and H_2.

40. A method of forming a silicon nitride film on a substrate, said method comprising the step of:

locating a substrate in a first chamber, said substrate having a silicon surface;

generating active nitrogen atoms in a second chamber; and

transporting said reactive nitrogen atoms from said second chamber into said first chamber and reacting said silicon surface with said reactive nitrogen atoms to form a silicon nitride film on said substrate.

41. The method of claim 40 wherein said reactive nitrogen atoms are formed from an annealed gas comprising N_2.

42. The method of claim 40 wherein said reactive nitrogen atoms are formed from an annealed gas comprising ammonia (NH_3).

43. A method of forming a tantalum pentaoxide dielectric film, said method comprising the steps of:

placing a substrate into a deposition chamber;

providing a metal organic tantalum containing precursor into said chamber;

providing nitrous oxide (N_2O) into said chamber;

thermally decomposing said metal organic tantalum containing precursor in said chamber to provide tantalum atoms; and

reacting said tantalum atoms with said nitrous oxide (N_2O) to form a tantalum pentaoxide (Ta_2O_5) dielectric film on said substrate.

44. The method of claim 43 further comprising the step of heating said substrate to a temperature between 300-500°C while providing said metal organic tantalum precursor and said nitrous oxide (N_2O) into said chamber.

45. The method of claim 43 wherein said metal organic tantalum containing precursor is selected from the group consisting of TAT-DMAE and TAETO.